Treatment of severe localized pulmonary interstitial emphysema by selective bronchial intubation

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Summary

A pre-term infant being ventilated for respiratory distress syndrome developed severe localized pulmonary interstitial emphysema which was successfully treated by selective bronchial intubation.

KEY WORDS: pulmonary interstitial emphysema, despiratory distress syndrome, pneumothorax, patent ductus arteriosus.

Introduction

Pulmonary interstitial emphysema (PIE) occurs in babies being ventilated for respiratory distress syndrome. It is often an incidental radiological finding, but may occasionally be so marked as to result in bulla formation with mediastinal shift.

The mortality is high (Coradello, Fodor and Simbruner, 1980) and several treatments have been suggested including rapid hand ventilation with 100% oxygen (Ng and Easa, 1979), lobectomy (Bamer *et al.*, 1980) and selective bronchial intubation (Brooks *et al.*, 1977). We describe an infant treated by selective bronchial intubation. Intubation of the right main stem bronchus in order to collapse the left lung is a technically simple procedure and we feel that it should be used as the initial management for localized left PIE.

Case report

The baby was the first of twins born at 29 weeks gestation weighing 1.2 kg. She required ventilatory support from birth with a fraction of inspired air that is oxygen (F_{iO_2}) of 1.0 for severe respiratory distress syndrome which was confirmed radiologically. In the first 24 hr, the highest peak inspiratory pressure was 20 cmH₂O and the ventilatory rate never exceeded 30 breaths per min.

On day 2, hyperinflation of the right lung was noted but resolved spontaneously by day 5 and did

not recur. During this time her oxygen requirements also decreased, the F_{iO_2} falling to 0.3. A left-sided pneumothorax on day 5 was satisfactorily treated using a chest drain connected to an underwater seal drain. A second left basal pneumothorax on day 8 required a further intercostal drain.

Pulmonary interstitial emphysema of the left lung was first documented on day 12 with contralateral mediastinal shift, but this initially did not result in any clinical deterioration and the F_{iO_2} was unaltered at 0.3. However, on day 13 she developed a severe respiratory acidosis (arterial pH 7.15 P_{CO_2} 8.3 kPa) requiring both an increase in the F_{iO_2} and ventilatory rate with radiological evidence of increasing left PIE, a large left emphysematous bulla with mediastinal shift to the right, and right upper lobe collapse (Fig. 1).

The right main stem bronchus was selectively intubated with dramatic clinical improvement. Only 90 min later, a repeat chest X-ray showed collapse of the left lung, a reduction in the size of the bulla and re-expansion of the right upper lobe (Fig. 2). Selective bronchial intubation was continued for 48 hr after which time it was replaced by a routine nasotracheal tube. Mild left PIE without bulla formation was noted 3 days later, but this was not associated with any change in her clinical state.

Assisted ventilation was required for a further 19 days. A large patent ductus arteriosus was ligated on day 31.

She was discharged at the age of 2½ months, weighing 2.25 kg when a chest X-ray showed mild bronchopulmonary dysplasia. She has continued to do well.

Discussion

Macklin (1939) described the histopathological development of PIE in experimental animals, indicating that the air leaks from overdistended alveoli into the pulmonary perivascular sheaths and that air may then track to the mediastinum. This results in an

FIG. 1. Left emphysematous bulla with mediastinal shift and collapse of right upper lobe.

FIG. 2. Collapse of left bulla and re-expansion of right upper lobe.

increase in perivascular sheath pressure with diminished blood flow to the affected part of the lung with serious clinical consequences. Extension of the perivascular air may then cause a pneumothorax, pneumomediastinum or pneumopericardium. If PIE can be treated these serious complications may be prevented.

Selective bronchial intubation of the right main stem bronchus had a dramatically beneficial clinical and radiological effect in this infant. It is a technically simple procedure (Brooks *et al.*, 1977). The endotracheal tube was cut 2 cm longer than usual, the infant's head turned to the left and the tube inserted in the standard manner. The shape of the bifurcation of the trachea permits easy access to the right main bronchus.

We suggest that the collapse of the right upper lobe may have been due to kinking of the right upper lobe bronchus by the mediastinal shift and when this was reduced, the bronchus re-opened and the upper lobe re-expanded. The subsequent recurrence of mild left PIE can be explained by the removal of the endobronchial tube after only 48 hr. Other authors (Brooks *et al.*, 1977) suggest that selective intubation should be continued for at least 5 days to prevent recurrence. This case confirms that localized PIE can be treated easily by selective bronchial intubation with dramatic clinical improvement.

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